

WHAT IS CLAIMED IS:

1. A vehicle collision state detecting device of a vehicle, comprising:
 - a front vehicle structural section having a predetermined collision collapsing characteristic;
 - 5 a tension member with a prescribed initial tensile force extending in a width-wise direction of the front vehicle structural section; left and right tensile force sensors arranged on the front vehicle structural section to measure left and right tensile forces of the tension member; and
 - 10 a collision state identifying section configured to identify a collision state of the vehicle based on a comparison between the left and right tensile forces of the tension member measured by the left and right tensile force sensors.
2. The vehicle collision state detecting device recited in claim 1, wherein the front vehicle structural section includes
 - 15 a left side structural member configured with a rigidity balance to collapse inward when subjected to a left side load oriented in a widthwise direction of the vehicle;
 - a right side structural member configured with a rigidity balance to collapse inward when subjected to a right side load oriented in the widthwise direction of the vehicle;
 - 20 a left side deformable member arranged on a forward tip end of the left side structural member;
 - a right side deformable member arranged on a forward tip end of the right side structural member; and
 - 25 a bumper reinforcement arranged crosswise in the widthwise direction of the vehicle with end portions fixedly coupled at front end parts of the left and right easily deformable members.
3. The vehicle collision state detecting device recited in claim 2, wherein the tension member includes a wire extending along the bumper reinforcement between the left and right structural members.

4. The vehicle collision state detecting device recited in claim 1, wherein
the tension member includes a wire extending in the widthwise direction of the
vehicle with end portions fixedly coupled at lateral parts of the front vehicle structural
5 section.

5. The vehicle collision state detecting device recited in claim 1, wherein
the collision state identifying section is configured to identify the collision state as
a front collision when the left and right tensile forces of the tension member measured by
10 the left and right tensile force sensors both decrease below the initial tensile force that
existed before a collision and the left and right tensile forces of the tension member are
approximately equal to each other after the collision.

6. The vehicle collision state detecting device recited in claim 1, wherein
15 the collision state identifying section is configured to identify the collision state as
a simple offset collision when one of the left and right tensile force sensors detects a
decrease in one of the left and right tensile forces of the tension member below the initial
tensile force that existed before the collision on the side where a collision occurred, and
the other of the left and right tensile force sensors detects an increase in one of the left and
20 right tensile forces of the tension member on the left and right tensile forces of the tension
member above the initial tensile force that existed before the collision on the side where
the collision did not occur.

7. The vehicle collision state detecting device recited in claim 1, wherein
25 the collision state identifying section is configured to identify the collision state as
a pole collision when the left and right tensile forces of the tension member measured by
the left and right tensile force sensors both increase above the initial tensile force that
existed before a collision.

30 8. The vehicle collision state detecting device recited in claim 1, wherein
the collision state identifying section is configured to identify the collision state as
an oblique offset collision when the left and right tensile forces of the tension member

measured by the left and right tensile force sensors both decrease below the initial tensile force that existed before a collision and the left and right tensile forces of the tension member are not approximately equal to each other.

5 9. The vehicle collision state detecting device recited in claim 1, wherein
the collision state identifying section is configured to determine a threshold value
for activating at least one passenger restraining device in accordance with the collision
state identified based on the comparison between the left and right tensile forces of the
tension member measured by the left and right tensile force sensors.

10 10. The vehicle collision state detecting device recited in claim 9, further
comprising
a deceleration sensor configured to measure a deceleration of the vehicle; and
the collision state identifying section being further configured to calculate a
15 velocity waveform with respect to time based on the deceleration measured by the
deceleration sensor and activate the passenger restraining device based on the calculated
velocity waveform and the threshold value determined by the collision state identifying
section.

20 11. The vehicle collision state detecting device recited in claim 1, wherein
the collision state identifying section determines an activation timing with which a
passenger restraining device will be activated and a passenger restraining force based on
an amount of decrease with respect to time in the left and right tensile forces of the tension
member measured by the left and right tensile force sensors.

25 12. The vehicle collision state detecting device recited in claim 1, wherein
the front vehicle structural section is configured to deform such that left and right
lateral side portions collapse inward relative to the vehicle at side locations, respectively,
that are in front of a respective one of the left and right tensile force sensors when
30 subjected to a load oriented in the widthwise direction of the vehicle.

13. The vehicle collision state detecting device recited in claim 1, further comprising
- a lock mechanism configured to divide and fix the tension member in such a manner that independent tensile forces are generated in left and right section of the tension member when a collision occurs.
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14. The vehicle collision state detecting device recited in claim 13, wherein the lock mechanism includes a plurality of protruding parts around a periphery of a plurality of stopper parts connected to the tension member and is configured in such a manner that when a load is imparted to the protruding parts, the structure surrounding the protruding parts deforms and causes the protruding parts and stopper parts to interfere with each other to restrict movement of the tension member.
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15. The vehicle collision state detecting device recited in claim 14, wherein the protruding parts of the lock mechanism has a saw-tooth-shaped mountain structure and the stopper parts of the lock mechanism has a saw-tooth-shaped valley structure that mates with the saw-tooth-shaped mountain structure with the tension member being arranged between the saw-tooth mountain structure and the saw-tooth valley structure.
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16. A vehicle collision state detecting device comprising:
- front vehicle structural supporting means for providing structural support to a front portion of a vehicle;
- tensioned means for providing a prescribed initial tensile force extending in a width-wise direction of the front vehicle structural section;
- tensile force measuring means for measuring left and right tensile forces of the tensioned means; and
- collision state identifying means for identifying a collision state of the vehicle based on a comparison between the left and right tensile forces of the tensioned means measured by the tensile force measuring means.
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17. A vehicle collision state detecting device comprising:

a collision sensing device configured and arranged to be installed on a front portion of a vehicle to produce a collision state signal indicative of a detected collision state of the vehicle;

5 a collision state identifying section operatively coupled to the collision sensing device and configured to identify the detected collision state of the vehicle;

at least one passenger restraining device configured and arranged to be selectively activated; and

10 a control unit configured and arranged to selectively activate the at least one passenger restraining device differently depending on the detected collision state identified by the collision state identifying section.

18. The vehicle collision state detecting device recited in claim 17, wherein, the collision sensing device includes

15 a front vehicle structural section having a predetermined collision collapsing characteristic,

a tension member with a prescribed initial tensile force extending in a width-wise direction of the front vehicle structural section, and left and right tensile force sensors arranged on the front vehicle

20 structural section to measure left and right tensile forces of the tension member; and

the collision state identifying section is configured to identify the collision state of the vehicle based on a comparison between the left and right tensile forces of the tension member measured by the left and right tensile force sensors.

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19. The vehicle collision state detecting device recited in claim 17, wherein the control unit is configured and arranged to set an activation timing of the at least one passenger restraining device differently depending on the detected collision state identified by the collision state identifying section.

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20. The vehicle collision state detecting device recited in claim 17, wherein
the at least one passenger restraining device includes at least one air bag, and
the control unit is configured and arranged to inflate the at least one passenger
differently depending on the detected collision state identified by the collision state
5 identifying section.

21. The vehicle collision state detecting device recited in claim 20, wherein
the at least one air bag includes a first air bag and a second air bag, and
the control unit is configured and arranged to set an activation timing of the first
10 and second air bag differently depending on the detected collision state identified by the
collision state identifying section.

22. A method comprising:
sensing a collision state of a front portion of a vehicle;
15 producing a detected collision state signal in response to the collision state that was
sensed;
identifying the collision state of the vehicle as at least one of two different preset
based on a detected collision state by the collision sensing device; and
selectively activating at least one passenger restraining device differently
20 depending on the collision state identified.